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ABSTRACT

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A COMPARISON OF INSTRUCTOR-PACED AND SELF-PACED GROUPS IN A CRITERION-REFERENCED, MULTI-MEDIA EDUCATIONAL PSYCHOLOGY COURSE

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Abstract

This study examines the relationship between instructional mode (self-pacing vs. instructor-pacing) and student achievement in an undergraduate course in educational psychology. Measures of achievement as well as time to achieve criterion (defined as number of trials to attain a 70% criterion level) were taken. Data analysis indicated that students who completed the course in one semester in the self-paced instructional mode were superior in total course achievement (number of points accumulated) as well as in fewer trials to criterion or highest grade. Subsequent analysis of all self-paced students who completed the course indicated there were no significant achievement differences related to instructional mode although self-paced students took significantly fewer trials to criterion.

A Comparison of Instructor-Paced and Self-Paced Groups In A Criterion-Referenced, Multi-Media Educational Psychology Course

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Since the publication of Keller's "personalized system of instruction" (Keller, 1966, 1968) implementation of his approach has occurred in a variety of disciplines (Green, 1969; Hess, 1971; Koen, 1970; Moore, 1968). The literature available (Harrisberger, 1971; Hoberock, 1971; Keller, 1968; McMichael & Corey, 1969; Sheppard & MacDermot, 1970) has been largely devoted to the comparison of student achievement in traditional courses with that in courses employing Keller's procedures. One of the major emphases in courses utilizing Keller's approach has been that of "self-pacing" by the student. Most of the courses described as self-paced have not only included this feature but have also employed a variety of other innovating instructional methods (e.g., programmed texts, individualized study guides, multi-media programs, behavioral objectives and immediate feedback.)

It appears to have been the intent of most investigators to pursue the effect of varied instructional formats (e.g., Born et.al., 1972; McMichael & Corey, 1969; Sheppard & MacDermot, 1970) upon student achievement without controlling for instructional content in the examination of pacing variables. To date there has been no definitive research examining student achievement as a function of self-pacing with that

attained in a comparable course utilizing conventional instructor-determined pacing. In view of the considerable practical ramifications that self-pacing possesses (Harrisberger, 1971), examination of this aspect of PSI is indeed warranted.

The present investigation was designed to compare the performance of students who paced themselves through an undergraduate criterion-referenced course in educational psychology with that of students who were exposed to identical material but for whom more traditional instructor-determined pacing was required. Further, following Carroll (1963) and Bloom (1968), the variable of time in instruction was also examined as an additional means of assessing learning efficiency in a mastery learning, criterion-referenced educational program.

Method

Subjects

Two hundred and twenty-eight (228) sophomore and junior undergraduate students enrolled in a course entitled Human Growth and Development were ramdomly assigned to one of two instructional conditions: self-paced or instructor-paced. Due to scheduling difficulties and course changes, there were 118 students in the self-paced sections and 110 in the instructor-paced sections of the course. Of the original group, 7 instructor-paced students withdrew from the class and 4 students withdrew from the self-paced sections. The withdrawal rate reported here is considerably lower than those reported in the literature in analogous programs (Sheppard and MacDermot, 1970).

Of the students remaining in the course, 101 instructor-paced students completed the course in one semester with passing grades and two received failing grades. In the self-paced sections, 84 students completed the course with passing grades, 7 received failing grades, and 21 were given incompletes.[1] ACT scores were obtained for 110 students in the total group (61 from the instructor-paced section and 49 from the self-paced section). Using the two experimental groups as the independent variable and ACT scores as the dependent variable, Hartley's test for homogeneity of variance indicated that the two groups were homogeneous in aptitude.

Procedure

The course utilized in this investigation is a modified self-instructional course in educational psychology which is offered through a Learning Center. The course content is divided into four units of material as follows: Unit I, Principles of Growth and Development; Unit II, Classroom Management; Unit III, Statistics; and Unit IV, Measurement and Standardized Tests. The content is presented by means of closed circuit television programs, slide-tape programs, audiotapes, program notes and study guides for assigned readings. Each student receives behaviorally stated objectives for each of the four course units at the beginning of the semester. Evaluation of student

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[1]Of the 21 students receiving incompletes, 19 students subsequently completed the course in the following semester. Students in the instructor-paced sections were not permitted to take an incomplete in the course, except in extenuating circumstances, as would be the case with most traditionally taught courses.

performance in the course employs a criterion level of 70%. Adoption of the 70% criterion level in a mastery learning program was based on the rationale of Gronlund (1973). Since written work and the objective tests employed in the course are primarily at the upper levels of Bloom's Taxonomy, the 70% criterion was judged to be an effective level for material for which students would be expected to manifest differing developmental levels of mastery.

Grades in the course are based upon the student's total point count which in turn is composed of points achieved by completion of the following: attendance at one small group discussion for each unit (optional but 10 points are given), completion of one objective test for each of the four course units, and submission of two written assignments, one each in Units III and IV. Written papers are graded on the basis of superior/acceptable/unacceptable, with "acceptable" defined as 70% of the total points possible for the assignment. Students are permitted to re-submit written assignments and to re-take tests (until all test forms are exhausted) in order to raise their grade to criterion level or to improve a grade which is already at the 70% criterion. Those students who exhaust all test forms of any given unit without attaining criterion level are permitted to proceed in the course only after consultation with the course instructors.

Instructor-Paced sections: Students used the course materials in the Learning Center working at their own rate within the scheduled deadlines for individual units. In addition, students in these sections met for one hour a week with the same instructor for discussion of course-related

material as well as for the small group discussion associated with each of the four course units. Deadlines were established for submission of written assignments and for unit tests. Thus instructor-paced students were paced through the course as in a conventional college class although their progress through programs in the Learning Center was done at the convenience of their own schedule.

Self-paced students: Students in these sections were required to meet with an instructor for the first two class periods of the semester. The purpose of these two section meetings was to orient the students to the course and to clarify any student problems. Further, slide-tape programs and additional faculty supervision were provided for those students who were unfamiliar with the operation of the Learning Center and the operation of Learning Center equipment. Students were warned about procrastinating in their progress through the course and were urged to begin the course as soon as possible. Small group discussions for each of the course units were scheduled for students in these sections over a 3-4 week block of time based on prior experience with the course. Attendance for these four discussion groups was not mandatory; however, ten points were awarded for attendance at each of these meetings. When the student felt that he was prepared to take a unit test, he was permitted to sign up for a scheduled testing time. Throughout the semester instructors were available for counseling and tutoring purposes but students in the self-paced sections were not obligated to meet with instructors on a regular basis.

Results

Student Achievement in one semester

In order to investigate the relationship between pacing condition and student achievement, a one-way analysis of variance was calculated with pacing condition as the independent variable. Student achievement as the dependent variable was defined as the student's total point count in the course at the end of the semester. This total was composed of the points gained for written assignments, attendance at group discussions and objective test scores. In instances where the student had retaken tests or re-submitted written assignments, the highest score obtained on the activity was used.

Results of this analysis indicated that self-paced students achieved significantly higher levels of performance ($\bar{X}$ = 1058.45) than instructor-paced students ($\bar{X}$ = 1038.10) ($F = 4.79$; $df = 1/183$, $p < .05$). In addition, student achievement was examined within each individual unit using the highest unit test score obtained as the dependent variable. In each of these four one-way analyses of variance the self-paced group exhibited greater achievement than did the instructor-paced group. However, only on unit four did the differences in achievement between pacing conditions reach statistical significance ($F = 10.68$, $df = 1/183$, $p < .01$).

Although there was a mean difference of twenty points between modes of instruction on the total achievement for the course, both mean achievement scores fell into the "B" category which had been predetermined and

established on the basis of the minimum course criteria. Therefore, a two-by-two chi square contingency table was set up with the independent variables being the two instructional modes and the two grade categories of "A" and "C". Cell frequencies became the dependent measure. The chi square value (9.42) was significant at the .01 level and indicated that the self-paced students achieved more "A's" and fewer "C's" than the instructor-paced students. Thus the differences in achievement between the two modes of instruction were significant in terms of mean achievement as well as in terms of final grade for the course. There was no relationship between aptitude as assessed by ACT scores and achievement. Assuming randomization of subjects, these differences in achievement can only be ascribed to the effects of experimental treatments.

Time in instruction in one semester

In order to examine the relationship between pacing condition and time in instruction as an index of learning in a mastery model of instruction, an analysis of variance was calculated with pacing condition as the independent variable and the number of trials required for the student to obtain the 70% criterion as the dependent variable. Therefore, time in instruction might be more accurately described as trials to highest grade. The use of number of trials to criterion as an index of total time in instruction has been used previously (Camplese, et al., 1973) when measurement of total time spent on course activities is not feasible (e.g., when students engage in reading and writing activities outside of the Learning Center setting).

Four one-way analyses of variance were calculated by unit of instruction with the independent variable of pacing condition and the dependent variable of trials to criterion or to highest grade. In all four analyses self-paced students took fewer trials than instructor-paced students. However, only on Unit III did these time differences attain statistical significance ($F = 15.23$; $df = 1/183$; $p < .01$).

By summing the number of trials over all four units of instruction, a measure of total trials to final grade was obtained. A one-way analysis of variance with pacing condition as the independent variable and the total trials as the dependent variable revealed a significant difference between groups ($F = 7.68$; $df = 1/183$; $p < .01$). Over the entire course of instruction, self-paced students took significantly fewer trials to criterion or to highest grade than did instructor-paced students.

Student achievement and time in instruction for all students completing the course

As has been reported above, self-paced students ($N = 84$) completing the course within one semester achieved significantly higher performance levels ($\bar{X} = 1058.45$) than did instructor-paced students ($N = 101$) ($\bar{X} = 1038.10$). After combining the additional data obtained from the 19 self-paced students who completed the course in the subsequent semester, the mean achievement for all self-paced Ss ($N = 103$) dropped to 1047.38. Using the total number of self-paced Ss in an analysis of variance comparing total course achievement across pacing conditions, it was found that no significant difference existed between groups ($F = 1.016$; $df = 1/202$).

The distribution of scores as depicted in Figure 1 reveals the additional information obtained by the examination of self-paced data distinguishing the data from the 19 Ss who completed the course in the following semester from that of the 84 Ss completing the course in one semester. Although there are no significant differences between the performance levels of instructor-paced Ss ($\bar{X}$ = 1038.10) and the total group of self-paced Ss ($\bar{X}$ = 1047.38), the data plotted in Figure 1 indicate the bimodal distribution of the self-paced scores when the classification of course completion within one semester is employed.

In order to investigate the relationship between pacing condition and number of trials to highest grade for all students completing the course, the data from the 19 "incomplete" students were combined with those of the self-paced Ss who completed the course within one semester. An analysis of variance computed on total trials to criterion in the course as the dependent variable revealed a significant F ratio ($F = 5.49$; $df = 1/202$; $p < .05$). That is, self-paced students even with the inclusion of the 19 "Incompletes", still took fewer trials to criterion ($\bar{X}$ = 5.23) than did the instructor-paced Ss ($\bar{X}$ = 5.73). Using the classification of time of course completion when the total group of self-paced students is employed, self-paced students completing the course within one semester ($\bar{X}$ = 5.11) exhibited the most efficient progress through the course, followed by the instructor-paced Ss ($\bar{X}$ = 5.73) in contrast to the 19 "Incompletes" ($\bar{X}$ = 5.79).

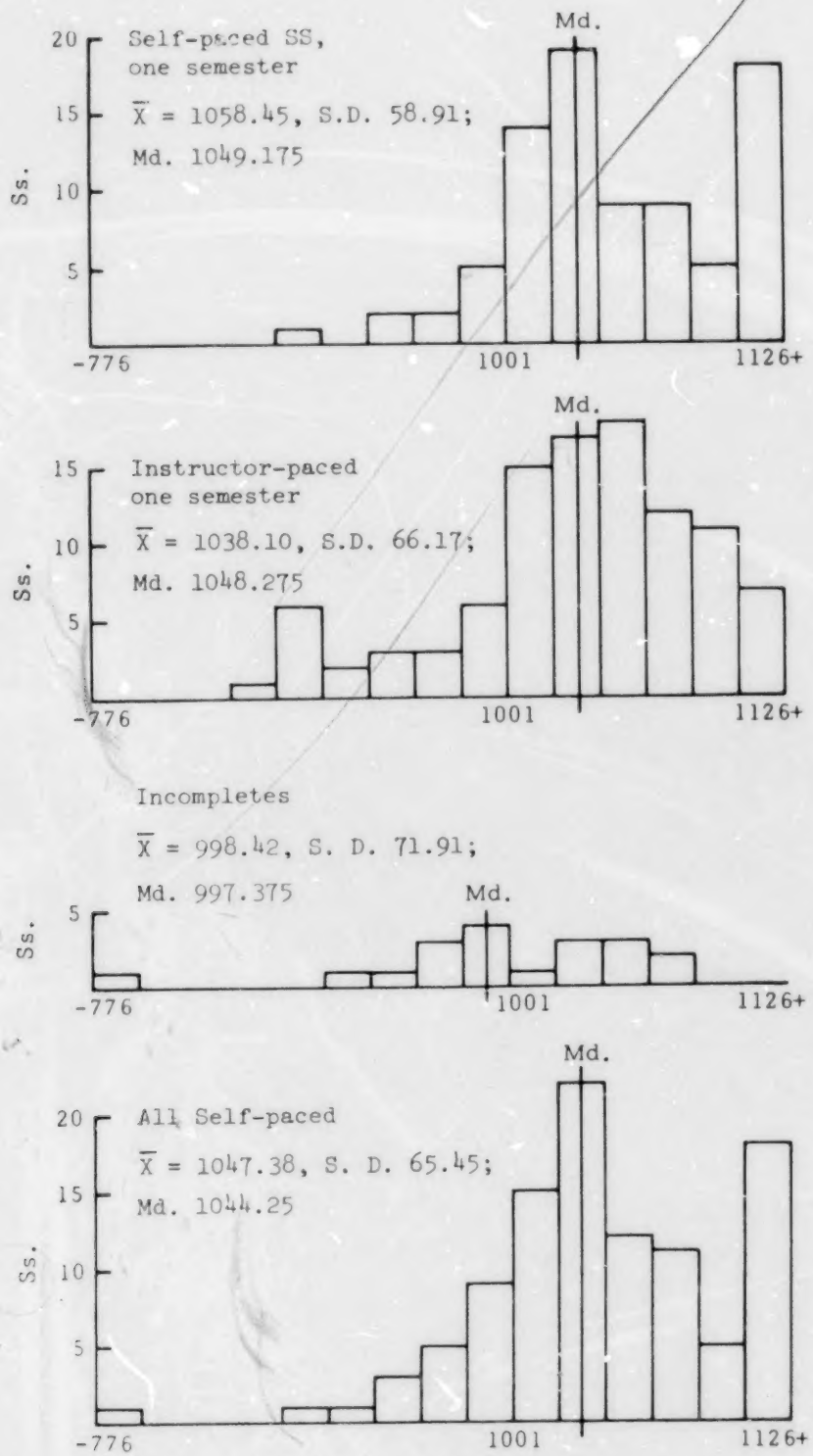

Figure 1:

Distribution of Achievement
by Instructional Mode

Discussion

Although the results of the present study indicate that student achievement and time in instruction are related to the instructional mode employed, this interpretation must be qualified by consideration of the time of course completion. The effects of instructional mode on student achievement within one semester indicate superiority of the self-paced mode. However, when all students in the self-paced mode are contrasted with instructor-paced students on measures of total course achievement, these differences are no longer significant.

In contrast to the results on the achievement measure, time in instruction as assessed by number of trials to criterion indicates superiority of the self-paced instructional mode in both analyses. The superiority in learning efficiency remains significant even with the inclusion of students who completed the course in a subsequent semester. One might argue that the group of students who completed the course in the following semester did, in fact, demonstrate a high degree of inefficiency in progress through the course. Nevertheless, when the measure of learning efficiency is number of trials to attain criterion, it may be noted that all students in the self-paced mode progress more effectively through the materials than do students in the instructor-paced mode.

The present findings are in agreement with previous investigations (Born, 1972; Keller, 1968; McMichael and Corey, 1969; Sheppard and MacDermot, 1970) reporting superior performance with a PSI approach within one semester. Additionally, the results of this investigation are

strengthened by the correction of previous design inadequacies with the use of identical content materials so that the examination of the pacing variable is not confounded with other influences. Although it was not possible to control for aptitude in the assignment of students to instructional mode, examination of the available information on aptitude (ACT scores) indicated homogeneity of variance for the groups. This would appear to be sufficient indication that the achievement data are not confounded by systematic differences in aptitude between groups.

In view of the growing concern with student withdrawals or failure to complete course requirements in PSI-based programs, the present results are highly significant. First, it should be noted that students who fail to complete the course within one semester achieve at a significantly lower level ($\bar{X}$ = 998.42) than either instructor-paced students ($\bar{X}$ = 1038.10) or self-paced students who complete in one semester ($\bar{X}$ = 1058.45). Yet all students did achieve the established course criterion. The lack of significant achievement differences between instructional modes when scores for all students in the course are examined is attributable to the inclusion of the group of "Incompletes" yielding a bimodal distribution of scores for students in the self-paced mode.

Criticisms of the reported high levels of achievement in Keller-based programs have frequently cited the withdrawal of academically less successful students (Born, 1971; 1972). It would appear that students who elected to complete the course at a later point in time do constitute a distinct subgroup within the self-paced sections based on their achievement

measures. Nonetheless, they do not constitute an unsuccessful group academically, since their performance level is above the specified course criterion which can be equated with successful performance.

Reliance upon a mastery model of instruction (Bloom, 1968; Carroll, 1963) leads to consideration of variables other than variation in achievement levels. Since exit behavior or achievement is specified in terms of the criterion employed, individual differences are then reflected in the variable of time in instruction. Analysis of the present data indicates that the self-paced mode of instruction is more effective. The finding remains significant even with the inclusion of the data from the imcompletes. This would then indicate the high degree of performance efficiency demonstrated by the students in self-paced sections during one semester of course work.

Previous writers (Born, 1971; 1972; Harrisberger, 1971) have suggested that students withdraw from PSI-based courses either because the course is too rigorous or because of the "procrastination" manifested by students in such programs. The present investigation was designed, in part, to examine the influence of instructor-determined deadlines upon student procrastination. In light of Harrisberger's suggestion (1971) that more frequent contact with an instructor might alleviate the procrastination frequently exhibited in such programs, the instructor-paced data merit additional consideration. Instructor-determined deadlines were introduced to minimize student procrastination. While incompletes were eliminated <u>de facto</u> for students in this instructional mode, the comparison with the one semester's self-paced

data reveal the cost with which this was accomplished. The achievement differences between groups are significant (although criterion was achieved readily by students in both instructional modes). More importantly the learning efficiency of the self-paced students is of great significance in such a comparison. It would seem that more frequent and regular contact with an instructor is not the solution for all of the logistical problems raised by PSI. Further, the issue has been raised as to which are the significant questions for applied research in PSI-based programs. If in fact the achievement issue is not as critical as time in instruction, then certainly the present use of trials to criterion should be augmented by the inclusion of more sophisticated indices of time.

Conclusion

The findings of this study suggest that self-paced instruction is a significantly more efficient mode of instruction than the more traditional teacher-paced mode. Of those students who completed the course in one college semester, where both experimental groups received the same content and were held to the same achievement criteria, the students who paced themselves through the course experienced significantly greater achievement and took significantly fewer trials to do so than those students who were paced through the course by an instructor. Comparison of data for all students who completed the course revealed no significant differences in achievement between the two instructional modes. Time in instruction as assessed by trials to criterion remained significant emphasizing the increased learning efficiency of self-paced students.

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